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LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
AND SALES



AUSTRALIA

Patents Act 1990

Original

PROVISIONAL SPECIFICATION

Invention Title: **MULTILAYER TUBE OF IMPROVED TENSILE STRENGTH**

The invention is described in the following statement:

MULTI-LAYER TUBE OF IMPROVED TENSILE STRENGTH

FIELD OF THE INVENTION

The invention relates to the field of manufacture of multi-layer paper tubing. In particular, the invention relates to an improved construction of tubular material having increased tensile strength and which is suitable for use as a mould for the casting of concrete columns.

BACKGROUND OF THE INVENTION

In building and construction industry, the casting of vertical concrete piles has become common practice for tasks such as setting the foundations for buildings, especially larger multiple storey constructions.

As such, numerous manufacturers have sought to provide more efficient and lower cost methods of constructing casting moulds for these concrete pillars. One such method is to provide a rigid tubing material which may be 'stood up' in situ, usually with the assistance of an auxiliary structure to ensure the tube remains upright, and into which the concrete is then poured and allowed to set. The tubing is then removed from the concrete column and may or may not be re-used depending on its construction.

The typical construction used in the prior art for single-use casting tubes is to create a rigid tube from multiple layers of kraft paper, a material whose properties are very familiar to the person skilled in the art. However, one issue encountered with kraft paper construction is that it tends to lose tensile strength when wetted, causing bulging or failure. Another problem encountered with such rigid casting tubes is that they tend not to be very space efficient, meaning they require an inordinate amount of space and expense to transport and store.

An approach taken in the prior art to the construction of such tubes is exemplified in US Patent No. 5,376,316, by Weekers, wherein there is described a tube being made essentially from multiple layers of kraft paper, but being sufficiently flexible to lay flat, reduce the volume taken up by the tube when not in use. This particular casting tube also includes a layer of plastic material within the layers of kraft paper for the express purpose of improving the waterproofing properties of the tube.

Nevertheless, the natural problem that is encountered when attempting to create a concrete casting tube which is sufficiently flexible to lay flat, is that the 'thinness' of the material which allows the requisite flexibility may also tend to lead to a reduction of strength in the tube. This can lead to undesirable effects 5 such as stretching or bulging of the tube during setting, which can lead to misshapen columns, or to tensile failure of the tube itself.

Another drawback with this construction is that while the plastic layer may provide some barrier to wetting of the kraft paper layers, it cannot completely prevent weakening of these layers where water might enter from both sides, or 10 especially if water enters through the ends of the tube.

Therefore, it is an object of the present invention to provide a multi-layer tubing material of improved tensile strength which is suitable for casting of concrete columns and which overcomes at least some of the tensile strength problems associated with the prior art in that field.

15 SUMMARY OF THE INVENTION

According to one aspect of the invention, there is provided a multi-layer tube, wherein at least one of said layers is a woven polymer mesh.

According a preferred embodiment of the invention, there is provided a multi-layer tube for casting of concrete columns, said tube having a multiple layer 20 construction, wherein at least one of said layers is a woven polymer mesh. Preferably, the polymer material is high density poly-ethylene (HDPE). Preferably, the gram mage of the HDPE mesh is above 120 g/m², more preferably above 134 g/m². Preferably the tensile strength of the HDPE mesh is greater than about 6.5 kN/m in any direction. The HDPE mesh may take the form of a simple cross-25 weave or may be provided in any other suitable format.

Incorporation of this mesh as one of the layers in the tube not only assists in directly arresting the ingress of water into the tube structure, but as its tensile strength is not affected by water itself, it prevents the tensile strength of the overall tube being compromised by water ingress.

30 The invention is applicable to both rigid and flexible 'lay-flat' tubing.

With particular regard to the lay-flat tubing type, the woven structure of the polymer mesh assists in providing a greater degree of tensile strength than might be provided by a simple sheet of plastic material. In addition, the preferred HDPE

mesh is exceptionally good at resisting stretching or bulging when the tube is filled with concrete. This allows the provision of a lay-flat tubing which has the requisite strength for typical concrete casting operations.

In order to provide a concrete casting tube that is rigid, while retaining an ability to provide sufficient tensile strength even in damp conditions, a preferred structure for the tubing material is to have at least one layer of the woven HDPE mesh sandwiched between multiple layers of kraft paper, wherein the total thickness of the tubing material is between about 4 mm and 15mm.

Preferably, two layers of the HDPE mesh are included in the structure, at least one of which is most preferably located at the outer layers of the tube.

In order to provide a concrete casting tube that is strong, while retaining an ability to lay flat prior to positioning for concrete pouring, a preferred structure for the tubing material is to have two layers of the woven HDPE mesh bonded together and sandwiched between two layers of kraft paper, wherein the total thickness of the tubing material is no greater than about 3 mm.

In a further embodiment, where the waterproof nature of the entire structure is paramount, the woven HDPE material may be bonded to one or more additional layers of polymer sheeting, for example polyethylene.

Now will be described, by way of a specific, non-limiting example, a preferred embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In a preferred embodiment, the invention provides a rigid or flexible concrete casting tube constructed from multiple layers of material, wherein at least one of said materials is a woven mesh of HDPE strands. The general type of casting tubes contemplated by the invention is described in detail in US Patent No. 5,376,316 above, and the following description is made with reference to the general kind of structures described therein.

The invention provides a tubing structure substantially similar with that described therein, but in particular where one of the layers of this multiple-layer structure is a woven mesh of HDPE strands. An example of this kind of material is that supplied by Insulation Solutions, of 127 Dandenong-Frankston Road, Dandenong, Victoria 3175, Australia, under the name of "Metal Wrapping", item no. 1625.

This material has properties as outlined in Table 1.

Table 1.

Property	Specification
Description	A heavy duty wrapping material.
Structure	Coated HDPE weave, laminated to bleached kraft paper.
Tensile strength	MD 12.7 kN/m CD 6.9 kN/m
Puncture & Tear	MD 24 N CD 40 N
'Beach' Puncture	3.5 J
Water Absorption (Cobb @ 15 min.)	46 g/m ²

This material is particularly suited to this application due to its very high
 5 tensile strength, and in particular to its very high resistance to any level of stretching.

An ideal structure for a rigid casting tube incorporating this material would consist of at least six layers of kraft paper with two layers of the HDPE mesh bonded together and sandwiched therebetween. In particular, it is preferred that
 10 there be sufficient layers of kraft paper bonded to the inside of the HDPE mesh to ensure a smooth surface of the casting, and further layers of kraft paper bonded to the outside of said material. The overall thickness of the tubing material should be between about 4 mm and about 15mm in order to provide sufficient rigidity to stand up without assistance.

15 It will be appreciated by those skilled in the art that the invention is not only applicable to tubing constructed predominantly from kraft paper, and that this is merely one of the more common materials used in this industry and whose properties are likely to be enhanced by the invention.

For example, it would be possible to construct a casting tube by
 20 incorporating the HDPE mesh within multiple layers of another polymer material such as polyethylene. In such a case, it would be preferable to bond the layers

together by direct heat treatment, as opposed to using a specific adhesive material as is provided in the kraft paper construction.

An ideal structure for a flexible casting tube incorporating this material would consist of two layers of kraft paper, with two layers of the HDPE mesh 5 bonded together and sandwiched therebetween. The overall thickness of the tubing material should be less than about 4 mm in order to provide sufficient flexibility to lay flat when not in use.

It will further be apparent to those skilled in the art that the invention provides an improved construction of multi-layer tubes for a variety of different 10 applications, notwithstanding the preferred embodiments addressed above are addressed to concrete casting. It is apparent that the improved tensile strength of the tubing material provided by the invention will afford improved performance in many other applications where such properties are desirable.

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DATED this 30th day of July 2003
EZYTUBE PTY LTD

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WATERMARK PATENT & TRADE MARK ATTORNEYS
290 BURWOOD ROAD
HAWTHORN VICTORIA 3122
AUSTRALIA

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P23060AUP1 CJS/ALH